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(54) Gas flow device for automatic shotguns

(57) This is a gas-flow device for semiautomatic or automatic shotguns, which consists of a gas-flow cylinder, closed at the front part by a flange with gas discharge ports (17) around the ammunition magazine, opposite the cylinder, a circular valve (18) that moves axially for controlled opening and closing of the discharge ports. The valve is kept in the closed position by a prestressed spring (19) and it moves to the open position when the gas pressure in the expansion chamber increases beyond a set value.

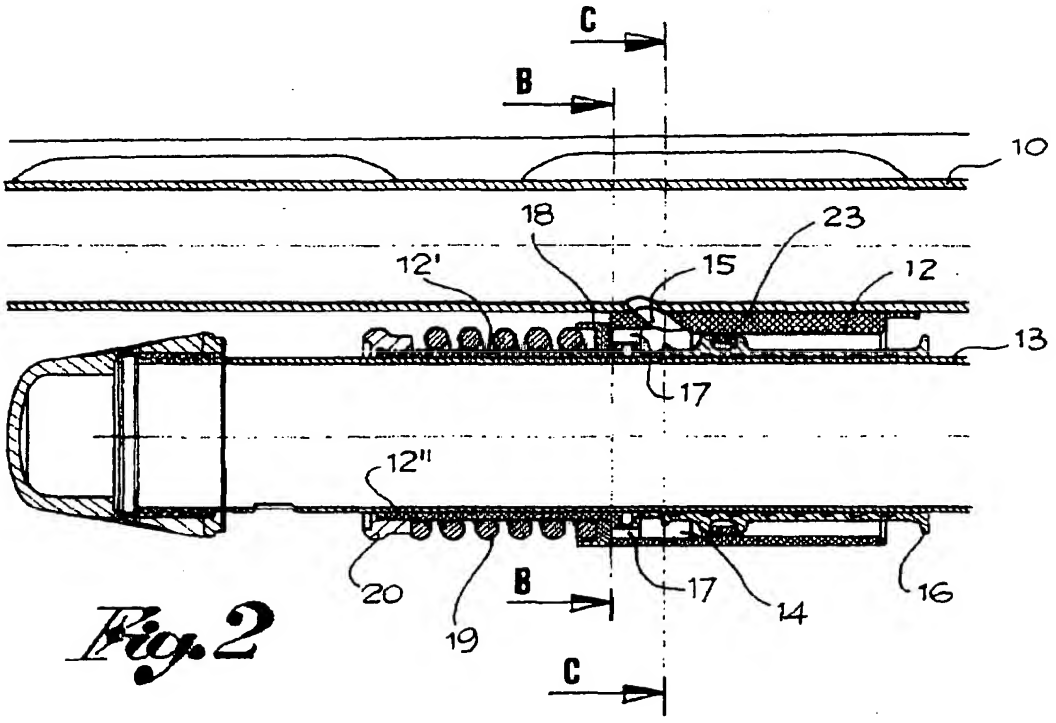

Fig. 2

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Description

[0001] This invention concerns, in general, the sector of semiautomatic and automatic shotguns with the so-called "gas-flow" operation, and, in particular, those guns furnished for purposes of functionality, reliability and durability with automatic compensation of the gas thrust on the moving parts, such as arming rods, breech-block, breech-block carriage, all intended to give the best possible constant working conditions.

[0002] Here below, reference will be made especially to smooth-bore shotguns of the type used for hunting, for which the invention, although of a general nature, was intended.

State of the art

[0003] Automatic or semiautomatic shotguns with a gas-flow device already exist. It should be noted that a semiautomatic shotgun with a smooth bore, in particular, can be used to shoot a very wide range of cartridges. For example, starting with the 12 calibre, with 24 gram cartridges, typically used in clay-pigeon shooting, up to the powerful 56 gram and even 64 gram cartridges in the versions with the 3½ inch super magnum cartridge chamber. Such a wide range means a great variety of working conditions.

[0004] As a result of this requirement, the "gas-flow" device of the latest versions is often equipped with a special valve, used to "partialise" the impulse of the venting gases when firing the most powerful cartridges, with the aim of keeping the rearming speed of the moving parts within acceptable limits and, thereby, avoiding premature breakage due to the excessive strain on components. Although various types of automatic compensation valve have been developed over the years, today there is a standardisation of the working principle. The compensation effect is achieved by means of venting the gas once a pressure limit inside the gas-flow cylinder has been reached; beyond this pressure, the valve, which is normally kept closed by a spring, allows a certain quantity of gas to be discharged.

[0005] The main characteristics required of a gas-flow device are:

- the performance, that is, the capacity for maintaining the shotgun working conditions as constant as possible, irrespective of the cartridge power, and ideal for carrying out the rearming and loading and for ensuring an acceptable life-span for the parts subject to mechanical stress. The valve must remain closed and hermetically sealed against leaking gas during the firing of less powerful cartridges in order to guarantee sufficient rearming speed, then open progressively as the power of the cartridge being fired increases.
- The seal, that is, the capacity for keeping to a minimum the passage of gases between the piston and cylinder which are vented from the barrel and necessary for the rearming of the moving parts.
- The lightness, simplicity and economy of construction.
- The reliability, intended as maintaining the calibration and, above all, as the capacity for self-cleaning of the solid residues of the gas combustion. This condition, if not obtained, may cause the devices to lose their functionality and, consequently, oblige the user to undertake frequent and costly maintenance. If this maintenance is not carried out, dangerous situations may arise due, for example, to the partial or total blockage of the venting holes, or a diminution of the duration of the various components.
- The possibility of adapting to various gun shapes, like the shape which is particularly sought after because it imposes no limits on the number of shots available, where the magazine passes inside the gas-flow cylinder and where the expansion chamber consequently assumes the characteristic ring shape.

[0006] At the current state of the art, there is no case in which the above-mentioned characteristics, which may be referred to briefly as self-compensating gas-flow device, self-cleaning with loop magazine, are all present in the same version.

Purposes and description of the invention

[0007] Given the above, it is the aim of this invention to supply a gas-flow device, in particular, for semiautomatic smooth-bore shotguns, incorporating as far as possible the characteristics mentioned above and which can be summarised as follows:

- an optimal self-compensation to give the gun components longer life;
- a self-cleaning function for the compensation valve and the piston sealing elements, giving a practically maintenance-free operation, while making the device safer and more reliable at the same time; and
- a construction which is simple, light and economic in the version with the loop magazine, and, therefore, unaffected by limits of ammunition capacity.

[0008] This aim and the advantages which derive from it are achieved with a gas-flow device for semiautomatic smooth-bore shotguns and a loop-type magazine in a gas-flow cylinder that consists of a pressure-type valve, with a ring shape, associated with said cylinder, placed around the magazine and held in a closed position by a spiral spring, suitably pre-stressed, and a valve with self-cleaning means on its rest plane.

[0009] With such a low-inertia ring valve, the gas-flow device has optimal self-compensation, given that the initial pre-stressing of the spring is such as to keep the valve closed and prevent the gas being discharged from

the gas-flow cylinder when firing weak cartridges, and to allow a gradual opening in proportion to the strength of the cartridges, thereby allowing a partial venting of gases at the higher pressures and maintaining the speed of the moving parts within optimal values.

[0010] The self-cleaning device is achieved by both a special shape of the valve rest/support plane, which exploits the principle of mechanical removal of the dirt after each shot, thanks to the valve motion with respect to the gas-flow cylinder due to the spring action in opening/closing the valve itself, and by self-cleaning means on the piston sealing elements, which exploit the direct action of the venting gases.

[0011] The ring shape of the compensation valve means that it can be placed around the magazine, without interfering with the latter, either radially or lengthwise, this being a particularly valued characteristic because, apart from permitting the usual loading of an extra shot, it means that other magazine extensions may be added in the future, to give an even better capacity than the one in question. Such a set-up, therefore, makes the entire device light and simple, since it incorporates in one single mechanical part, the cylinder, all the following functions: the expansion of the gas; the sliding of the piston and the guide for the compensation valve; the attachment of the pre-stressing and gas-venting collar.

Description of the drawings

[0012] Further detail about the invention will become clear from the following description, made with reference to the enclosed drawings, which are indicative and not binding, and where:

Fig. 1 shows the barrel and gas-flow device of a semiautomatic shotgun of the type used for hunting and clay pigeon shooting;
Fig. 2 shows a cross-section of enlarged parts of the barrel and the gas-flow device illustrated in Fig. 1;
Fig. 3 shows a cross-section according to line B-B, indicated in Fig. 2;
Fig. 4 shows a cross-section according to line C-C, indicated in Fig. 2; and
Fig. 5 shows a cross-section according to line D-D. indicated in Fig. 3.

Detailed description of the invention

[0013] In these designs of a semiautomatic shotgun with gas-flow for hunting/clay pigeon shooting, of the type shown here, a barrel 10 is represented with its respective breech 11. In an intermediate part of the barrel a gas-flow cylinder 12 is fixed, crossed co-axially by a tubular-shaped magazine 13, supported at the rear by the said breech 11 of the barrel and extending forward towards the muzzle. The cylinder 12 and the magazine 13 define between them a gas expansion chamber 14, which is substantially ring-shaped, which communicates with the inside of the barrel through at least one opening for venting the gas 15. In said chamber 14, a piston 16 slides between a forward and backward position. The piston 16 is driven along the tubular magazine 13, around it and sealed inside the cylinder.

[0014] On a front part, or rather facing forwards, the cylinder 12 is closed by a flange with gas discharge ports 17 and extends as a collar section 12', which surrounds the tubular magazine 13 and which has a diameter inferior to that of the circumference on which the ports 17 are set and which has a threaded section 12".

[0015] On said collar section 12', in front of the piston, a ringshaped compensation valve 18 is mounted and guided axially, functioning essentially as a valve breechblock, intended to open and close the gas discharge ports 17 according to the gas pressure in the expansion chamber 14. The valve 18 is pushed and normally kept in the closed position for the gas discharge ports 17 by means of a spiral cylindrical spring 19, which is prestressed by means of a collar 20 screwed onto the threaded part 12" of the sleeve part 12' that extends from the cylinder. The spring 19 is pre-stressed in such a way as to guarantee the closure and freedom from venting through the gas discharge ports 17 when low power cartridges are fired, and to give a progressive valve opening, allowing the gases to escape from the appropriate ports when medium and high power cartridges are used, in this way "partialising" the pressure impact of the gases on the piston 16.

[0016] The latter is moved from its forward position to a drawn back position by the pressure of the gases coming from the barrel, through the vent opening 15. As it draws back, the piston acts against a sleeve 21 and, via this, upon the moving parts in order to permit rearming of the said parts and the loading of a new shot, according to the usual procedure. The piston is maintained in the forward position by a return spring 22 associated with the sleeve 21.

[0017] The piston 16 is furnished with special sealing devices, such as an elastic band 23, with the purpose of preventing gas leaks from the expansion chamber 14. Said devices are contained within a housing, or hollow, 24, this hollow being open in the direction from which the gas originates in order to create a self-cleaning function for the hollow itself due to the direct action of the hot gases arriving from the opening of the gas-flow 15, associated with the rotation of the piston around the tubular magazine after every shot.

[0018] The hollow has a certain number of teeth 25, no less than two, with the task of drawing the elastic band into position and keeping it there.

[0019] There are also self-cleaning devices for the compensation valve 18, made as semicircular recesses 26. These have a sharp edge on the support plane of the valve in such a way that, on account of the angular movement of the valve with respect to the cylinder, due

to the spring action when opening and closing the valve itself, there is a mechanical action that removes the solid residues of the gases from the plane of the valve seal.

Claims

1. Gas-flow device for a shotgun with semiautomatic or automatic loading, having a barrel (10), a cylinder (12) fixed to said barrel, a tubular magazine (13) for ammunition passing co-axially through said cylinder, a ring chamber (14) for gas expansion between said tubular magazine and said cylinder and communicating with the inside of the barrel via at least one opening (15) for gas venting, and a sliding piston (16) sealed inside said gas expansion chamber between an inactive forward position and an active backward position, the forward position being maintained by a return spring (22) and the back position being caused by the pressure of the gases coming from the barrel via said vent opening, for commanding the functional bodies of the rearming and loading of the shotgun, **characterised by** the fact that said cylinder is closed in one of its front parts by a flange with gas discharge ports (17) and by the fact that around the ammunition magazine opposite said cylinder a circular valve (18) is mounted, which can move axially for controlled opening and closing of said discharge ports, said valve being kept in the closed position by a pre-stressed spring (19) and moving to the open position as a result of gas pressure in the said expansion chamber rising beyond a set value.

2. Gas-flow device according to claim 1, in which said cylinder has a sleeve portion (12') extending forwards around the ammunition magazine, said valve and said spring being placed around said sleeve, the pre-stressing of the spring being set in the factory with a collar (20) screwed around said sleeve.

3. Gas-flow device according to claims 1 and 2, in which there are various protrusions (26) on said portion of sleeve and/or on the front flange of the cylinder, between the discharge ports, for the self-cleaning of the valve surfaces.

4. Gas-flow device according to the previous claims, in which the piston has at least one hollow (24) radially, which contains at least one elastic band (23) for holding to the internal surface of the cylinder, said band being held between shoulders (25), said hollow being open on the side of the gases originating from the gas-flow opening in the barrel.

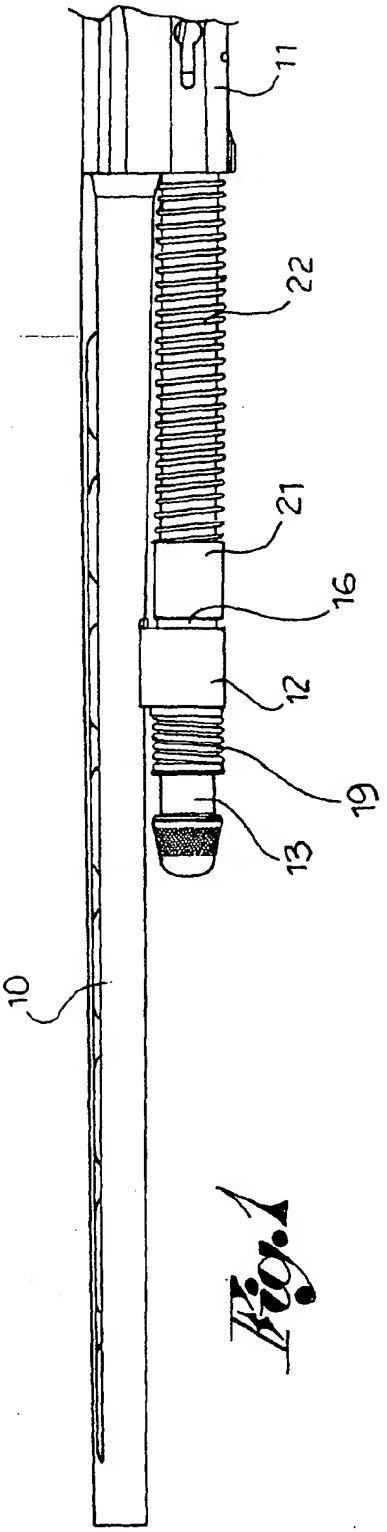

Fig.1

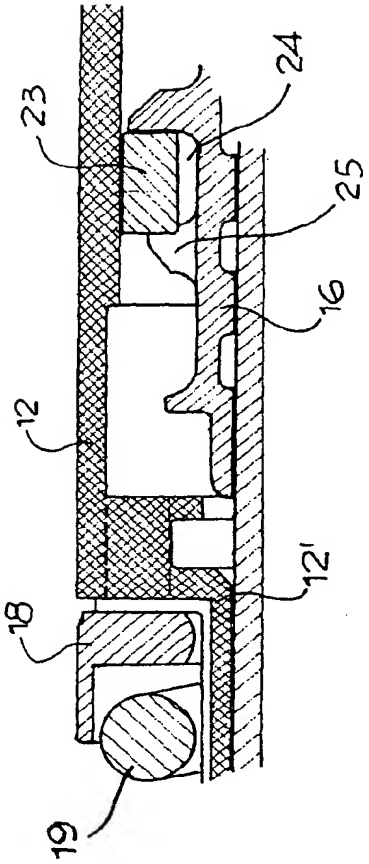

Fig.5

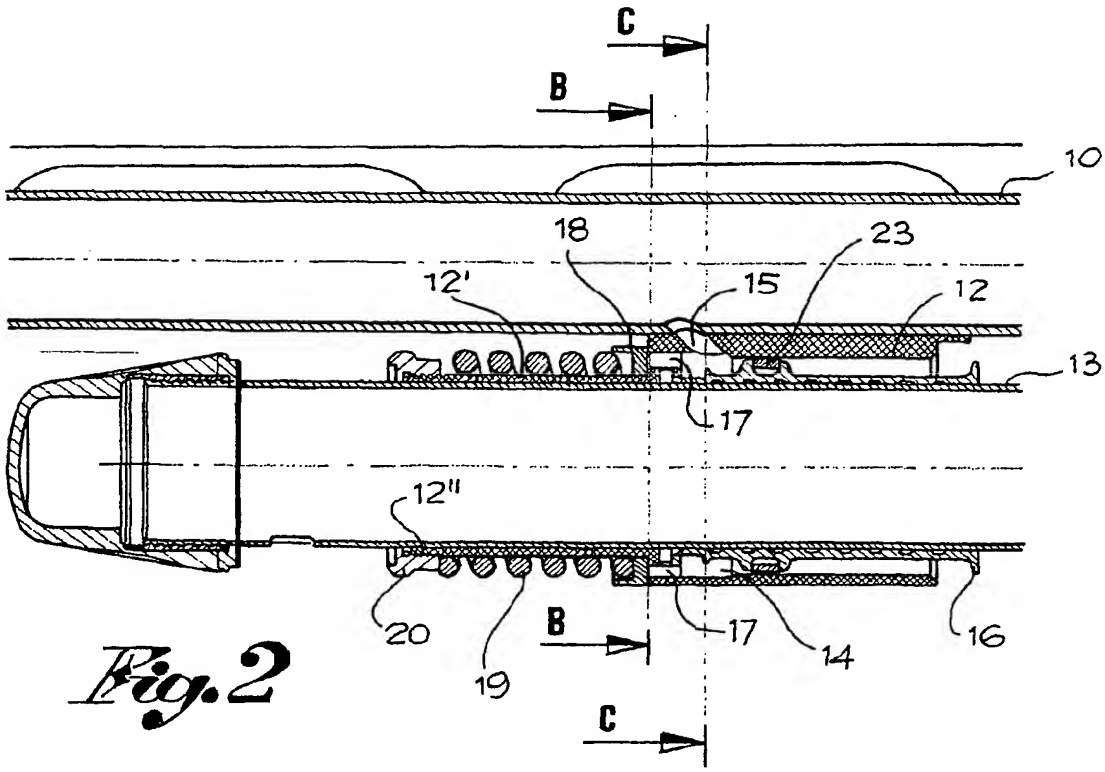

Fig.2

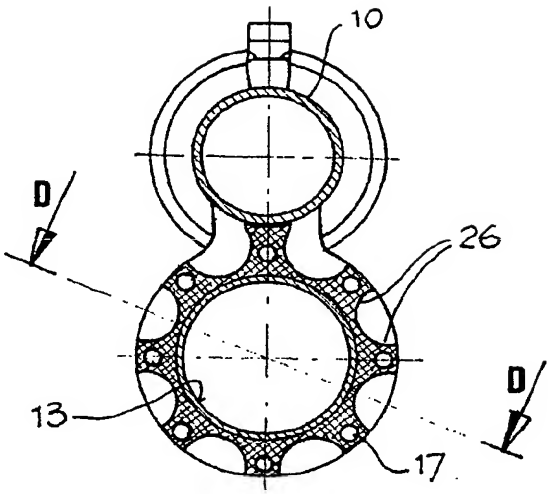

Fig.3

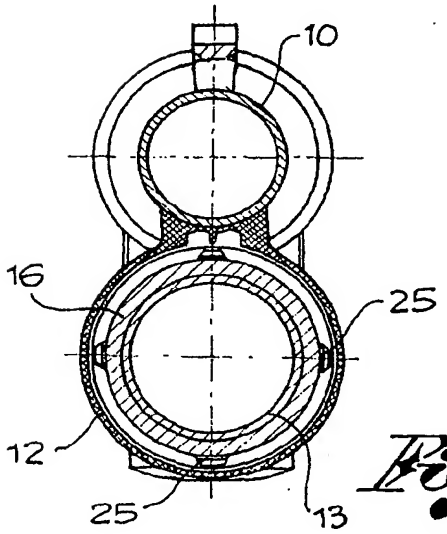

Fig.4

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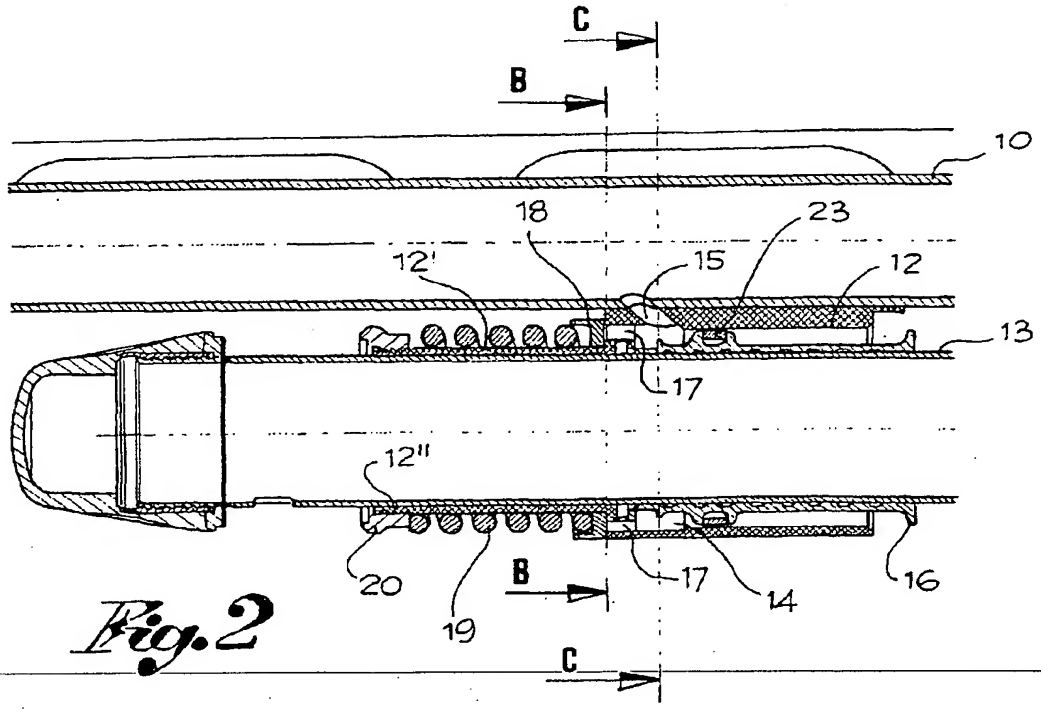

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 01 83 0307

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 August 2003	Menier, R

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